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TEXAS AGRICULTURAL EXPERIMENT STATION.

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OCTOBER, 1891.

LIVER FLUKES:

THE COMMON FLUKE (*DISTOMUM HEPATICUM*).

A NEW SPECIES (*DISTOMUM TEXANICUM*).

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

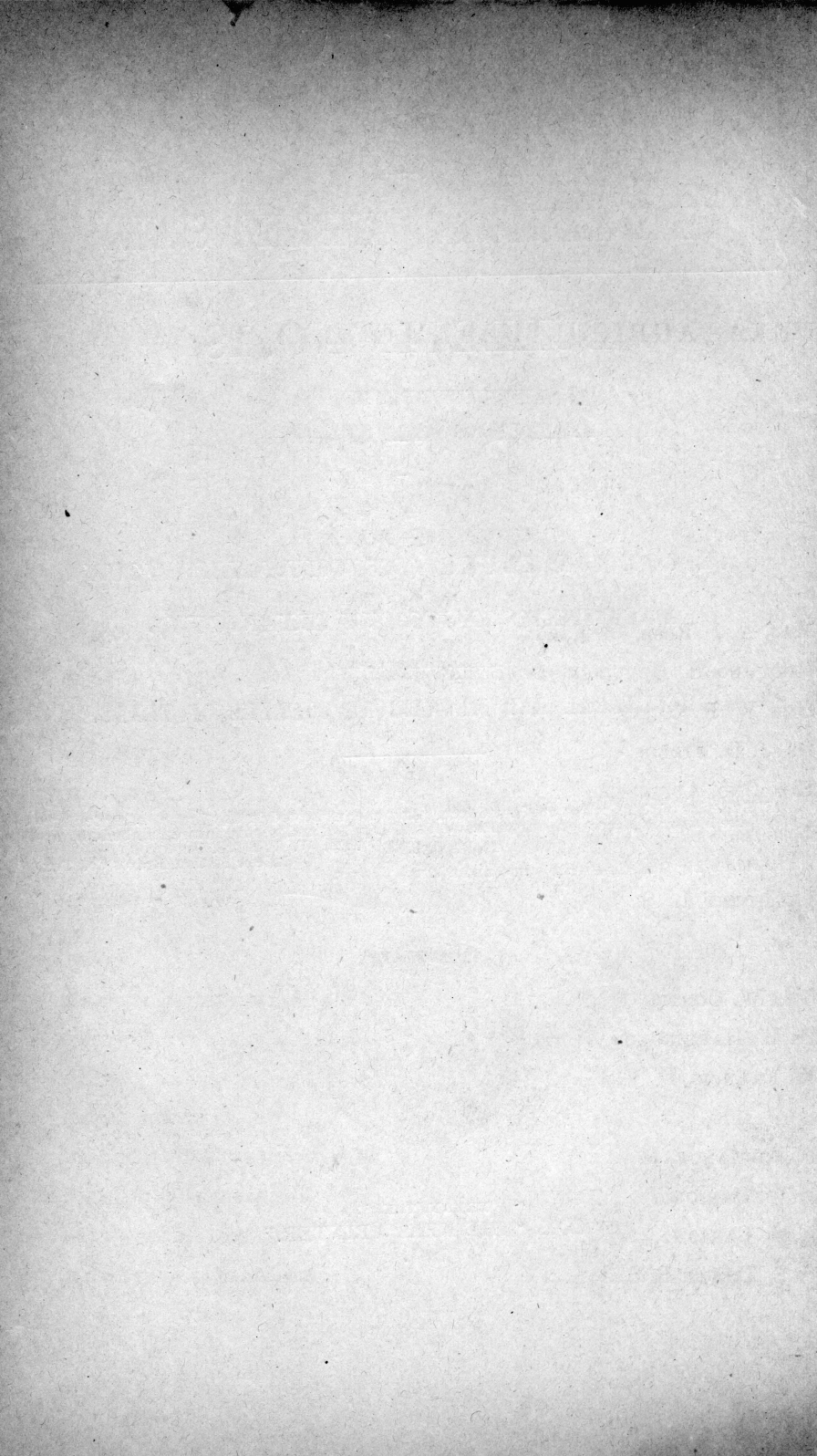
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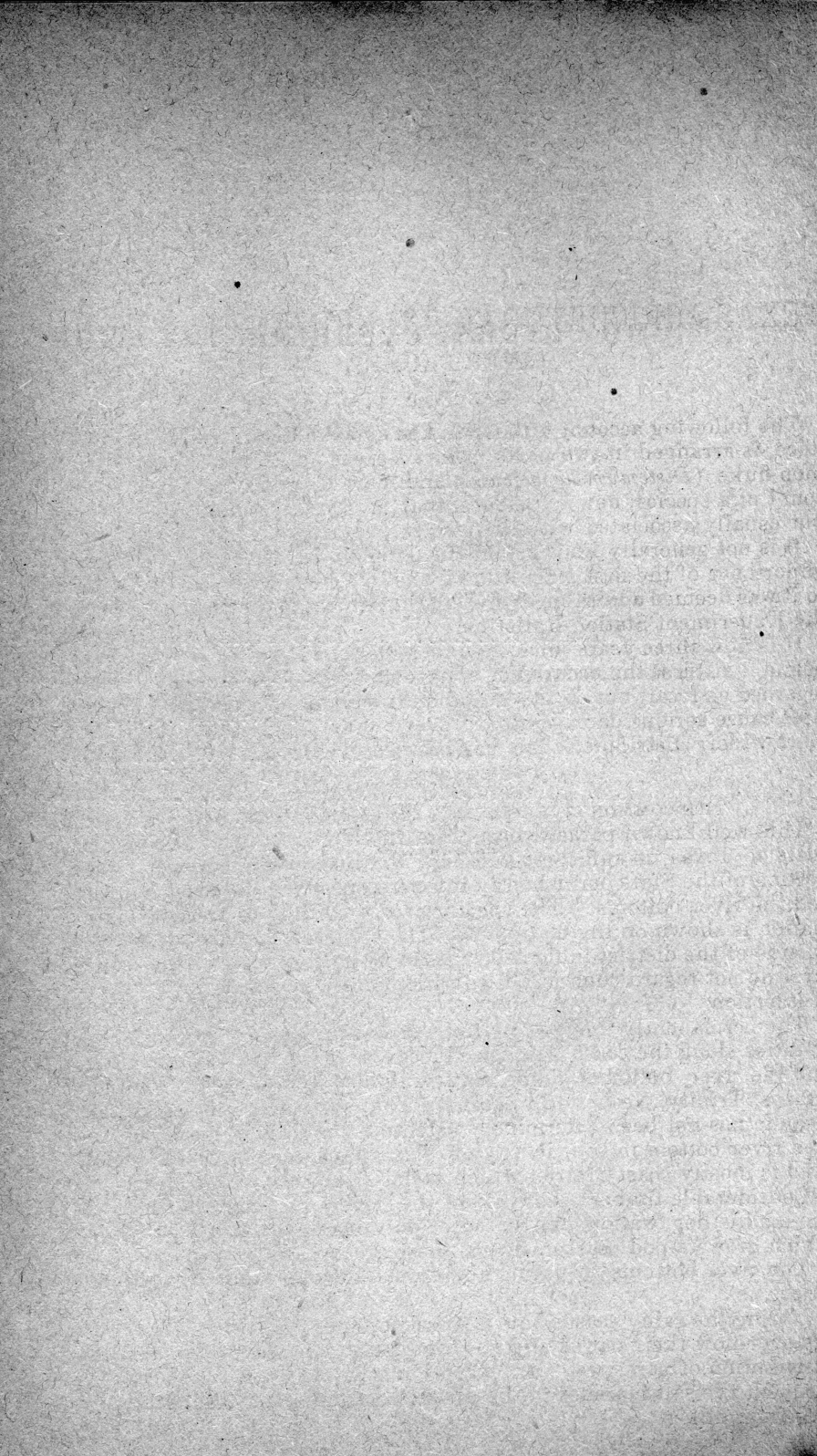
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TEXAS AGRICULTURAL EXPERIMENT STATION.

LIVER FLUKES.

(M. FRANCIS, D. V. M.)

The following account of liver-flukes and the disorders they produce, is arranged in two parts. Part I gives an account of the common fluke (*Distomum hepaticum*), and part II gives a partial account of a species, new to Science, that is found, sometimes alone, but usually associated with the former.

It is not generally known that the Trematoda bear an economic importance of the first magnitude to the live stock interests of Texas, so it was deemed advisable to present the subject to the public through the Experiment Station Bulletins.

It is now three years since the investigations here recorded were begun. At first the occurrence of enzootics of "Trematodism" were regarded as local, but on investigation it was found that these parasites cause serious damage almost every year, and that they are more widely distributed than has been supposed.

PART I.

THE COMMON LIVER-FLUKE (*Distomum Hepaticum*.)

This well known parasite occurs in the livers of cattle, sheep and goats of Texas, in sufficient numbers to cause great damage. The portion of the State permanently infected consists of the coast counties and the river bottoms. The specific area according to present information is shown on the map, plate VIII. I have found them also outside of the district indicated, but from the character of the country I do not regard such localities permanently infected, or a source of infection.

The permanently infected district, consists of about two rows of counties along the coast from the Nueces river to the Sabine river, and the river bottoms of the San Antonio, Gaudalupe, Colorado, Brazos, Trinity, Neches and Sabine. The condition along the Rio Grande has not been determined. Mention should be made of the Red river bottom in the vicinity of Texarkana as infected. The land is mostly coast prairie, which is flat or slightly rolling.

Considerable timber occurs along the rivers. Some portions of the land is hog wallow prairie; other portions have large ponds in which grows a pod bearing shrub; these are called "bean-ponds."

The river bottoms contain numerous bayous and over-flowed places.

During the rainy season this district becomes very wet. The rivers over-flow their banks and all conditions are favorable for the distribution of parasites. An exception must be made of stock that frequent the salt marshes in the district, as these are comparatively free from flukes.

DESCRIPTION OF THE PARASITE.

Body flattened, leaf like, pale brown, irregular, the adult from 18 to 31 mm long, from 4 to 13 mm wide, oblong, oval or lanceolate, larger and rounder in front, where it is abruptly contracted in such a way as to present a conical neck; attenuate and obtuse behind. Skin bristling with numerous little points directed backward. Oral sucker terminal, rounded. Ventral sucker large, projecting, with a triangular opening 3 mm behind the first. Intestine with two ramified branches visible through the skin and of a deep shade. Penis projecting in front of abdominal sucker, always recurved. Vulva very small, situated at the side of the male orifice or a little behind. Eggs brown or greenish, ovoid; length from 0.130 to 0.145mm; width from 0.070 to 0.090mm (Neuman). Copied from "Animal Parasites of Sheep," by Dr. Cooper Curtice.

The habitat of the adult fluke is the bile ducts of the liver of cattle sheep, goats and other ruminants, and occasionally in other domesticated animals. They are also reported by Murray in the lungs of Texas cattle. (Am. Vet. Review).

The life history of the Parasite, as determined by Leuckart and by Thomas is exceedingly interesting and wonderful.

It is briefly as follows: The fertile eggs leave the adult fluke by the genital pore, in great numbers. They are carried through the bile ducts to the intestines, from which they pass with the excrement. If by good fortune they arrive in fresh water, the eggs hatch in from 3 to 5 weeks. The little lid on one end of the egg suddenly flies open from the struggling of the embryo within, and soon the embryo escapes. This embryo is just visible to the naked eye. It is provided with fine hair-like projections, called cilia, which enables it to swim with great rapidity. In some experiments made in this laboratory some time ago, I was so fortunate as to witness the escape of the embryo as described. The time required for the eggs to hatch was 36 days in the first instance, and 34 days in the second, when kept in a watch glass at ordinary temperature.

This embryo immediately seeks a fresh water mollusc, into whose body it bores its way with a beak-like projection with which the anterior portion of its body is provided. The English investigators have found *Limnæustrunculatus* as the host. If the embryo fails to find a suitable snail it soon dies. Those I had under observation died in from 8 to 10 hours. Having a suitable mollusc, the embryo bores into the interior of its body by a rotary motion and encysts near the respiratory apparatus. It is now called a *sporocyst* in whose interior new forms develop called *redix*. The *redix* produce in their interior other forms called *cercariæ* which are active creatures.

The *cercariæ* escape from the snail and encyst on the herbage which is devoured by animals, or they may be taken in the drinking water. They find their way to the liver where they develop into mature flukes and thus the cycle of life is completed.

These changes or stages take place mostly during the summer months when molluscs are abundant and other conditions are favorable.

For the details of these processes scientific readers are referred to the literature on the subject.

EFFECTS OF THE PARASITE.

The invasion of the liver by the cercaria is not manifested by unfavorable symptoms. Some observers assert that there is a marked tendency to fatten for about two months. Probably the first thing to attract attention is the death of a few weak lambs early in the fall. The general havoc makes its appearance later, especially during the late winter or early spring. If present in limited numbers no marked deviations from health are noticed. So common are these parasites that it is exceptional to find a liver entirely free from them at any time of the year, and especially so during the spring. Even cattle slaughtered for beef, and in good condition, harbor a few during the entire year.

If the flukes are present in large numbers, serious damage results. Their presence in the bile ducts in sufficient numbers, obstructs the free passage of that fluid and therefore increases the tension on the liver cells that secrete the bile; this causes a considerable quantity of the bile to enter the blood, and therefore the animals appear jaundiced.

The walls of the bile ducts become thickened and are often coated with hard grit-like crusts. The bile becomes ropy and of a peculiar slimy appearance. These conditions existing, the circulation of the blood is retarded, the animals become pale (anæmic), weak, poor in flesh and dropsical. The dropsy of the abdomen is considerable and this gives the animal a "pot-bellied" appearance. Dropsy appears, also, between the lower jaws on account of the position of the head when grazing. This condition is called "water-jaw." As the disease progresses, sheep lose portions of their wool. Extreme emaciation and debility follow, and frequently a profuse watery diarrhoea sets in which is usually fatal.

The symptoms just stated are so conspicuous that stockmen call the disease "water-jaw and scours." In the localities I visited I received the impression that heifers coming two years old suffered more than any other age. Many of these cattle and sheep die, and many of those that recover do not thrive the following summer, but remain poor and weak, and fail to breed.

On post mortem examination an enormous quantity of fluid (dropsy) is found in the abdomen; some of which is partly organized. The liver is literally rotten and in its bile ducts, great numbers of mature flukes are found. These on exposure extend and retract their bodies like a leech and eject the dark contents of their digestive tract per mouth. They curl and soon die. Their eggs are seen in the gall and gall bladder in great numbers.

Frequently a few adult flukes are found in the small intestine.

TREATMENT.

Medicinal treatment is of little value. Some improvement follows the use of tonics, but very little is accomplished. There can be no doubt as to the value of a liberal use of salt. This is suggested by the fact that stock that have access to salt marshes are comparatively free from flukes.

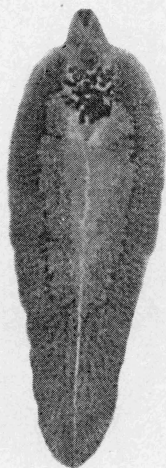
PREVENTIVE TREATMENT.

As the development of the parasite in its various stages depends on the presence of water and water animals, the disease can only occur when stock have access to such stagnant ponds of water which contain the cercariæ or to grass or herbage that has grown in damp, wet places; it is evident that when these conditions do not exist, the disease cannot occur, that is, the parasite will fail to complete the cycle of life.

The conclusion is obvious. Cattle and sheep must not have access to infected water holes, but must be furnished pure water.

One large pasture company in San Patricio county has demonstrated that an abundance of suitable water can be brought to the surface with wind pumps at a small cost.

NOTE.—The illustrations in this bulletin, with the exception of Plates II and VIII, are from photographs from nature by Dr. H. J. Detmers, Columbus, Ohio. Plates I. III. IV. V. VI. and VII. are each, *enlarged one-half*.



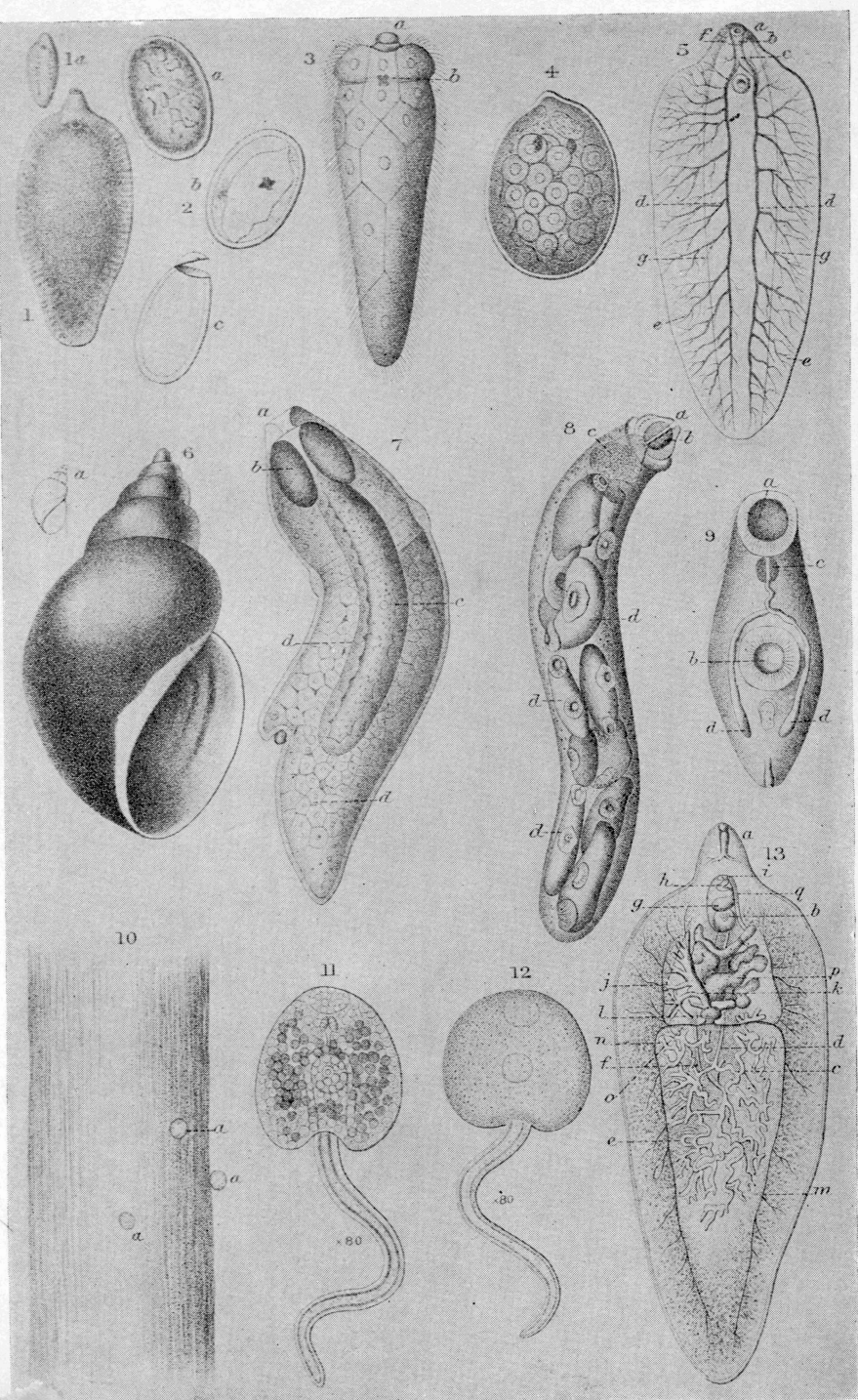
DISTOMUM HEPATICUM.

Plate II, with explanation as below given, is a reproduction from "Animal Parasites of Sheep," by Dr. Cooper Curtice—by the courtesy of U. S. Bureau of Animal Industry.

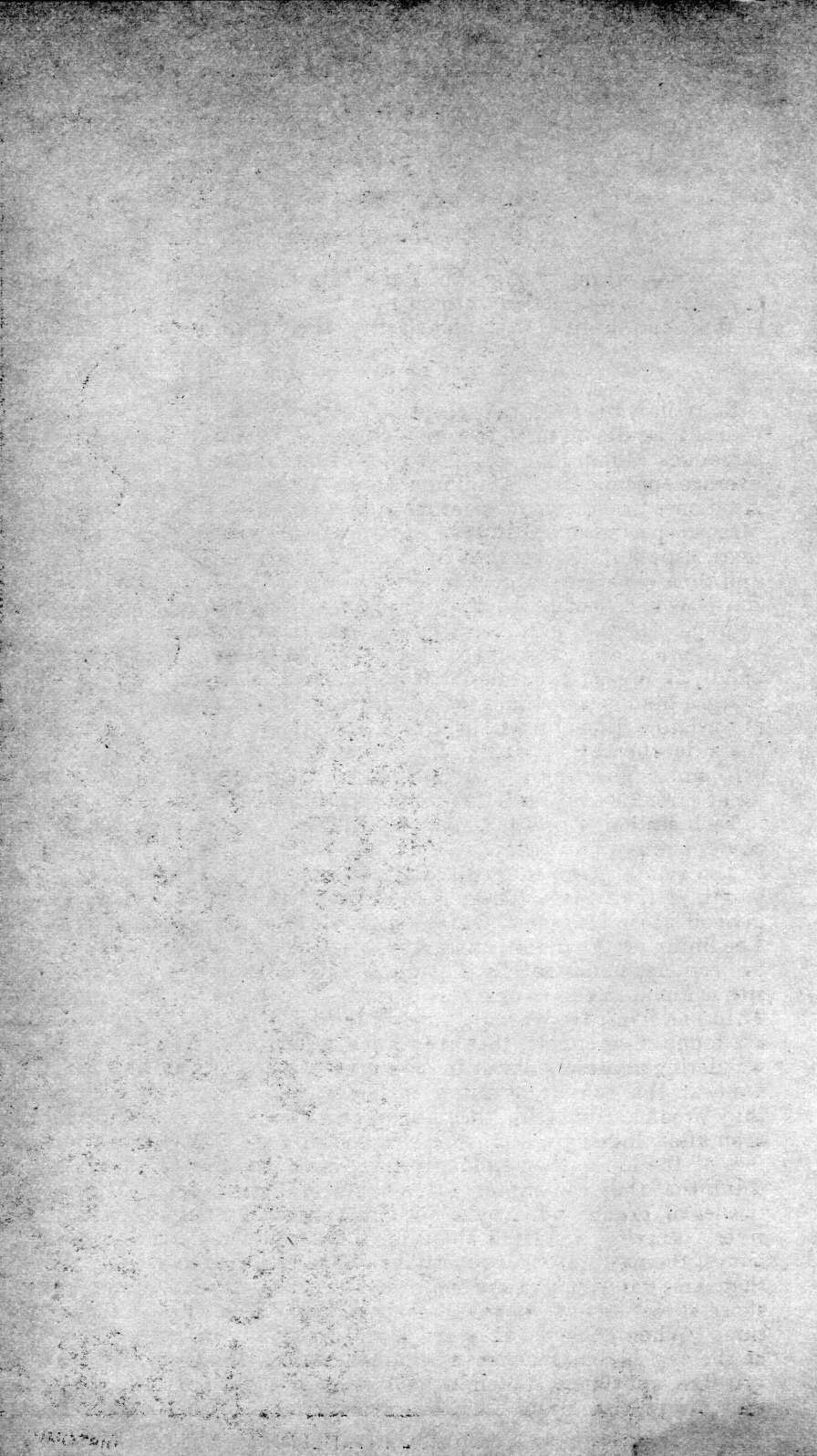
DISTOMUM HEPATICUM, Linn.

PLATE II.

- Fig. 1. Adult fluke, natural size: 1*a*, young fluke, natural size. (Raillet.)
- Fig. 2. Eggs: *a*, egg with developing embryo; *b*, egg with embryo; *c*, egg-shell. (Raillet.)
- Fig. 3. Ciliated and free embryo: *a*, perforating apparatus; *b*, ocular spot. (Leuckart.)
- Fig. 4. Encysted embryo found in snails. (A. P. Thomas.)
- Fig. 5. Diagram of digestive apparatus and nervous system: *a*, mouth sucker; *b*, pharynx; *c*, oesophagus; *d*, branches of intestine; *e*, their branchlets; *f*, nerve ganglia; *g*, ventral nerve. (Raillet.)
- Fig. 6. *Limnaeus trunculatus*, the principal snail which is the larval host of the fluke in Europe: *a*, natural size. (Raillet.)
- Fig. 7. Redia of *Distomum hepaticum*: *a*, mouth; *b*, pharynx; *c*, digestive tube; *d*, the so-called germinative cells destined to produce cercariae. (Leuckart.)
- Fig. 8. Redia containing cercariae: *a*, mouth; *b*, pharynx; *c*, digestive tube; *d*, *d*, cercariae. (Leuckart.)
- Fig. 9. Cercaria dissected from its cyst: *a*, anterior sucker; *b*, ventral sucker; *c*, pharynx; *d*, *d*, branches of the intestine terminating in caeca. (Leuckart.)
- Fig. 10. Grass stalk with three encysted young flukes, *a*, *a*. (A. P. Thomas.)
- Fig. 11. Free-swimming cercaria just before it is about to encyst. (A. P. Thomas.)
- Fig. 12. A slightly older stage than Fig. 11. (A. P. Thomas.)
- Fig. 13. Genital apparatus of the liver fluke: *a*, digestive tube; *b*, ventral sucker; *c*, anterior testicle; *d*, its deferent canal; *e*, posterior testicle; *f*, its deferent canal; *g*, seminal vesicle; *h*, genital sinus; *i*, cirrhus pouch; *j*, ovary; *k*, oviduct; *l*, shell-gland; *m*, yolk glands; *n*, longitudinal and *o*, transverse yolk-gland canals; *p*, uterus; *q*, vagina. (Raillet.)



DISTOMUM HEPATICUM.



PART II.

A NEW LIVER FLUKE. (*Distomum Texanicum*).

A PRELIMINARY REPORT.

It is now three years since I saw this animal for the first time. My attention was called to them by a butcher who regarded them as leeches, and desired an explanation of their nature.

DESCRIPTION OF THE PARASITE.

Body flat, liver colored, elliptical or oval, some wider behind than in front, adults 30 to 35 mm long and 20 to 30 mm wide. Some very large ones 73 mm long, smallest ones 8 mm long and 4 mm wide. The average specimens about 30 mm long. Skin of small and medium sized ones armed with numerous spines or points directed backward. Mature specimens destitute of spines except in patches or scattering ones, especially on ventral surface of body near the outer margin, and then generally large. Mouth terminal, sessile, not on a well defined neck. Ventral sucker large, muscular, 4 to 5 mm from preceding. Genital pore midway between the preceding, Penis not always protruding, but when so, curved slightly. Excretory pore small, at opposite extremity from mouth and slightly dorsal. The margin here is sometimes curved from both sides making it slightly obcordate. Eggs brown, oval or a little larger at one end, on which there is the cap. Length from 0.14 to 0.16 mm. Width 0.09 to 0.10 mm. The digestive tract consists of the mouth, which is made up of circular and radiating muscular fibres in which are situated. in each section, 4 or 5 large nucleated cells. From the mouth proceeds a muscular pharynx, then suddenly divides, a little anterior to the genital pore, into two main trunks which extend the entire length of the body. These give off from 12 to 16 branches, which give off secondary ones, which terminate in blind pouches or ~~cases~~ ^{cysts}. The lining of the digestive tract is disposed in finger-like points or projections, somewhat similar to the villi of mammals. This parasite is found in the liver tissue of cattle. I have found as many as 27 in one liver; the average number is from 10 to 15. These parasites are found in channels that they have produced. They seem to be wandering aimlessly about in any direction. I think the majority are near the convex or outer surface of the liver. The channels they produce admit the little finger, and these seem to heal or fill up soon after, leaving a red scar. Sometimes they perforate the surface of the liver, then suddenly turn back into the liver again. I think that they sometimes leave the liver and bore into adjoining tissues or organs, but I have not found them in other places than the liver. Having wandered about for some time they come to rest and encyst themselves. Frequently two have encysted together. Those that are wandering have their bodies covered with spines, while those at rest seem to have lost their spines—their organs of locomotion. When encysted they are always sexually mature. The wall of the cyst becomes dense and tough and is usually coated with a grit-like substance; butchers call such livers "shelly." I think they die in these cysts. These cysts contain a very dark, almost

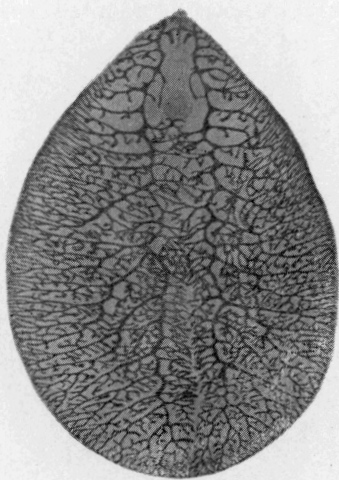
black, muddy liquid, which contains myriads of eggs. The gall and gall bladder of such livers are usually normal and in several instances in which I examined the entire quantity of bile, a very few eggs were found. I think the greatest number was 5 in the entire quantity of bile; and these I was not positive as being the eggs of this animal.

The life history of this species is unknown.

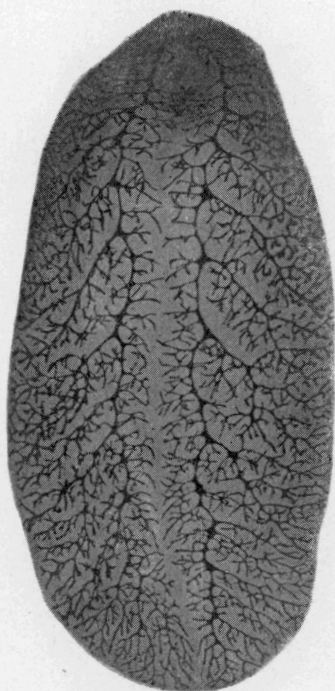
From the anatomical peculiarities of this animal one readily recognizes it as belonging to the *Distomidæ*.

In February, 1891, I sent specimens to Dr. Joseph Leidy, the distinguished scientist, for identification. He did not recognize them as known species. I have also submitted them to experts with the same result. On the suggestion of one expert, I have decided to propose the name of *Distomum Texanicum*, as a suitable one.

I trust that this brief and incomplete notice will stimulate observers, that we may learn its life history; for only when this is known can rational measures be adopted to lessen its prevalence.

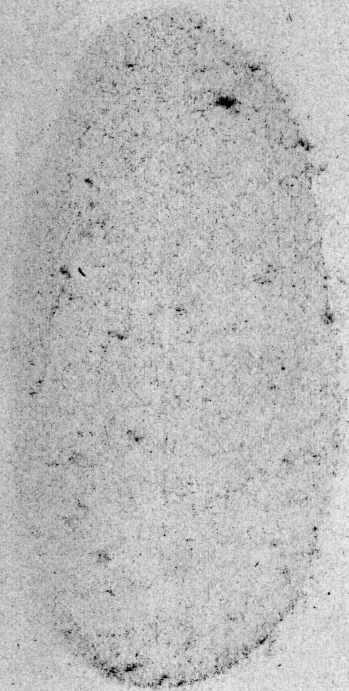


DISTOMUM TEXANICUM.

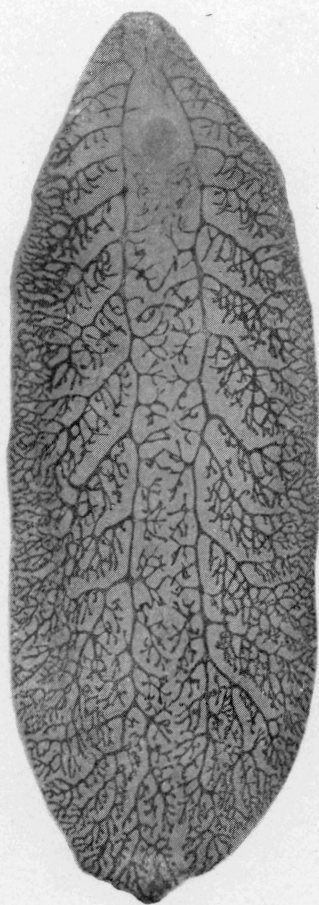


DISTOMUM TEXANICUM.

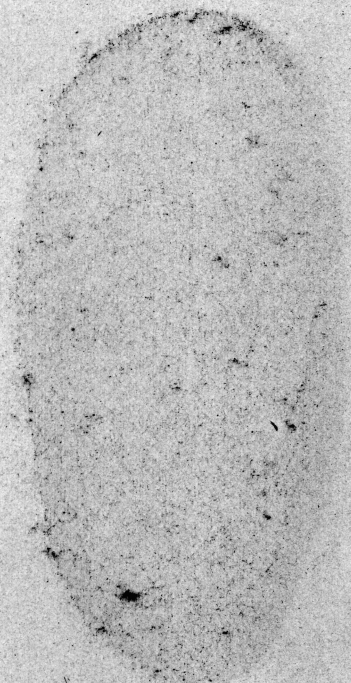
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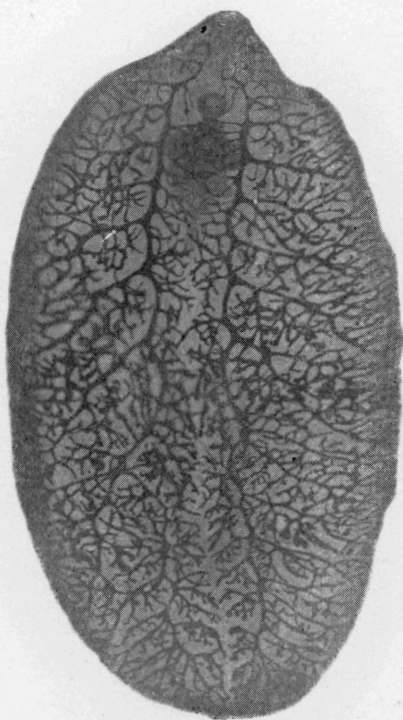


MUCHMARTEN MINGTARD

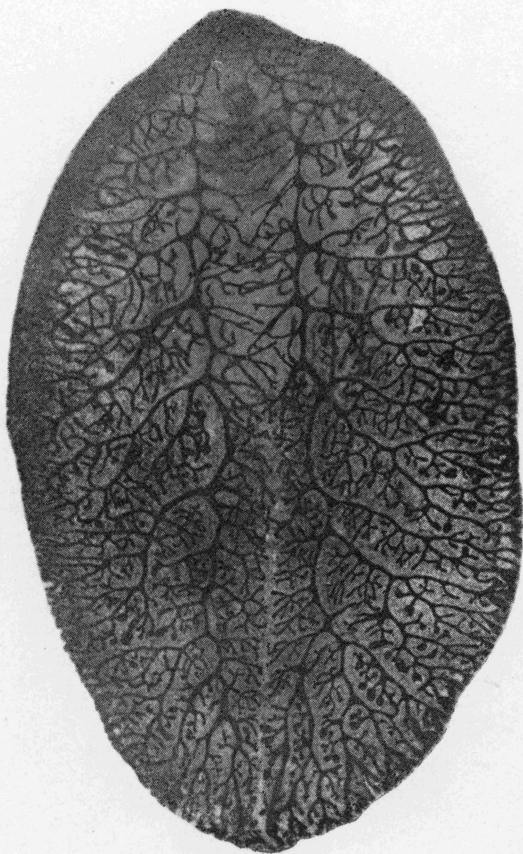


DISTOMUM TEXANICUM.





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